Mechanosynthesis: Green Chemistry applied to the design of copper-based photoinitiators

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Photoinitiated polymerization plays a more and more important role in industry as reflected by the continuously growing number of applications of this technique in conventional areas such as coatings, inks, and adhesives but also in high-tech domains, like optoelectronics, laser imaging, stereolithography and nanotechnology. Indeed, photopolymerization presents several advantages such as very short reaction time even at room temperature and the absence of solvents avoiding the formation of volatile organic compounds (VOC). Moreover, the possibility to irradiate with high precision specific zones allows the spatial-control of the polymerization.[1] Since 2011, photoinitiating systems able to initiate polymerization under soft light irradiation sources have been the subject of intense efforts to minimize the risks and the costs related to the conventional UV irradiation. However, even if some results are promising, so far the reported systems still present low to moderate reactivity and can hardly compete with actual UV systems.

In the search for new photoinitiating systems, copper (II) complexes have been identified as promising candidates for the development of photoinitiating systems usable in industrial processes for coating applications and the production of thick epoxy/glass fiber composites. Parallel to high photoinitiating efficiencies, the mechanosynthesis of copper complexes has been identified as a promising approach for the design of photoinitiators.

In this presentation, a comparison of copper complexes with reference photoinitiating systems is also provided. The development of photoredox catalysts based on copper complexes provides a means for creating photoinitiating systems with unprecedented reactivity. Currently, no photoredox catalysts exist on the market and the design of photoinitiators by mechanosynthesis is not under use in industry yet.

References :

[1] H. Mokbel, D. Anderson, R. Plenderleith, C. Dietlin, F. Morlet-Savary, F. Dumur, D. Gigmes, J.-P. Fouassier, J. Lalevée, *Polym. Chem*. **2017**, *8*, 5580–5592.